REMARKS

Applicant appreciates the thoroughness with which the Examiner has examined the above-identified application. Reconsideration is requested in view of the amendments above and the remarks below.

Amendments to the specification

Initially, applicant is correcting two errors of a clerical or typographical nature in the specification.

Claim objections

In response to the claim objections, applicant is renumbering the claims and claim dependencies as requested by the Examiner.

Rejection under 35 USC § 102

Claims 1-22 have been rejected under 35 USC § 102(b) as being unpatentable over Ausschnitt et al. U.S. Patent No. 5,965,309 (the "Ausschnitt '309 patent"). Applicant respectfully traverses the rejection.

The present invention is directed to a process for controlling focus parameters in a lithographic process used in manufacture of microelectronic circuits. The process uses the measurement of at least two focus setting targets exposed at different known focus offsets (or settings) relative to a functional lithographic circuit element so as to determine unambiguously both the sign and magnitude of a focus deviation/correction in the functional lithographic circuit elements. Such sign and magnitude are important to the implementation of feedback/feed forward focus control systems. The exposure at different focus offsets stipulated by the invention can be accomplished simultaneously with the production of the functional circuit elements, and corrections to focus error

may even be made dynamically, wafer-to-wafer. The use of at least two targets exposed at different focus settings is a consequence of the fact that the measured quantity, e.g. an array width, exhibits a focus dependence that is more or less symmetric about the desired focus setting (approximately parabolic), so that measurements of targets a single focus setting can only determine the magnitude of the focus deviation.

In contrast to the claimed invention, the disclosure of the cited Ausschnitt '309 patent discloses only that exposure/focus matrices of the type shown in Figs. 9-16 may be used to control batches of production lots. This is described in column 22, lines 20-55, wherein it is explained that a patterns in each production lot will be reviewed for focus and exposure dose, and when variations in the last *N* lots are determined, new corrections to focus and exposure dose can be made to the next production lot. Thus, there is no disclosure that there are multiple patterns at different focus settings on the same substrate containing a functional circuit element. Moreover, in column 22, line 56 to column 23, line 3, the difficulty of determining the sign of focus correction is explained, and the suggested solution is not to use multiples of the patterns being measured, on the same substrate, but to use the "conventional technique of measuring a product wafer on which focus has been intentionally varied." Thus, the patterns being tested cannot themselves be used to determine focus corrections, and the Ausschnitt '309 patent teaches away from using multiple test patterns at different focus settings on the same substrate to determine the sign of focus deviation.

Claims 1 and 16

Claim 1 has been amended to incorporate the subject matter of claims 2 and 11, and a portion of the subject matter of claim 9. Claims 2 and 11 have been cancelled. In both claims 1 and 16, the step of providing the semiconductor wafer substrate on

which there are to be lithographically formed functional circuit elements has been made explicit. Thus, claims 1, 16 specifically recite that both the first and second targets which are compared and used to determine a desired focus setting of the energy beam are present on the same wafer substrate on which the functional circuit elements are formed.

The claimed subject matter of claims 1 and 16 is nowhere suggested by the Ausschnitt '309 patent since the cited patent does not disclose placing two focus setting targets on a wafer substrate containing a functional circuit element. By the claimed method, the present invention is able to use the determination of the desired focus setting of the energy beam to correct energy beam focus during lithographic forming of the functional circuit elements on the same wafer substrate as the two targets, as recited in claims 1 and 16. The claimed placement and use of the two focus setting targets on the same wafer permits focus control to be made during the lithographic production on a single wafer. This presents a significant, novel and unobvious improvement over the prior art Ausschnitt '309 patent, which did not place two targets on a production wafer, and which relied on changes made only after entire productions lots were processed, and not individual production wafers. Ausschnitt '309 required production to stop, and test wafers to be exposed, whereas the present invention permits changes to be made wafer-to-wafer, without interrupting production. Moreover, the present invention also permits simultaneous determination of both the magnitude and sign of focus deviation on a product wafer, which the Ausschnitt '309 patent could only do by previously conventional and tedious measurement techniques.

Claims 9 and 19

Claims 9 and 19, dependent on claims 1 and 16, respectively, recite that at least one of the focus setting targets is lithographically formed simultaneously with forming the functional lithographic circuit elements on the wafer substrate. This is nowhere stated in the Ausschnitt '309 patent.

Claims 13 and 20

Claims 13 and 20, dependent on claims 1 and 16, respectively, recite that the determination of the desired focus setting of the energy beam is based both on the sign and on the magnitude of a focus correction feedback. (An amendment has been made to both these claims to replace "the" with "on" for clarity.) This is nowhere disclosed or suggested in the Ausschnitt '309 patent, which actually teaches away from such a process by using previously conventional techniques to determine sign of the focus correction, and then only after entire lots of production have been processed.

For the reasons given above, the claims of the instant application are both novel and unobvious over the cited prior art. It is respectfully submitted that the application has now been brought into a condition where allowance of the entire case is proper. Reconsideration and issuance of a notice of allowance are respectfully solicited.

Respectfully submitted,

Peter W. Peterson
Reg. No. 31,867

DeLIO & PETERSON, LLC
121 Whitney Avenue
New Haven, CT 06510-1241
(203) 787-0595

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service on the date indicated below as first class mail in an envelope addressed to Mail Stop Non-Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Name: Barbara Browne Date: September 4, 2003 Signature: